Synthetic biology strategies for the production of plant polyphenolic compounds

Joana L. Rodrigues*, Daniela Gomes, João Rainha, Lígia R. Rodrigues

University of Minho
School of Engineering

CENTRE OF BIOLOGICAL ENGINEERING

Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal
* Corresponding author: joanarodrigues@ceb.uminho.pt

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Introduction

Polyphenols biological activities

- Antioxidant
- Anti-inflammatory
- Anticancer
- Would healing
- Skin treatment disorders
- Anti-viral
- Anti-septic
- Anti-aging
- Anti-diabetic
- ...

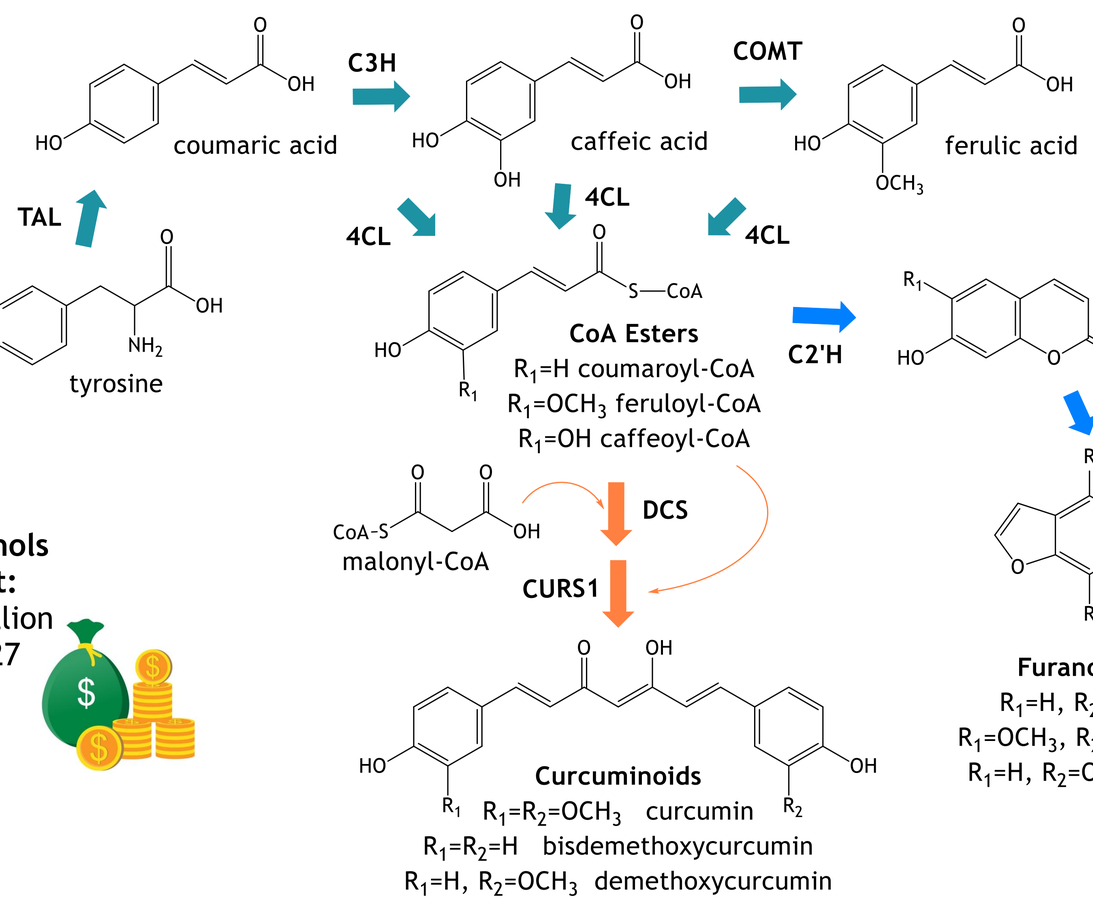
Extraction from plants

- Low amount
- Low yields and purity
- Limited by seasonality
- Limited by pests and extreme weather
- High land / water investment
- Environmentally unfriendly process
- Expensive downstream process

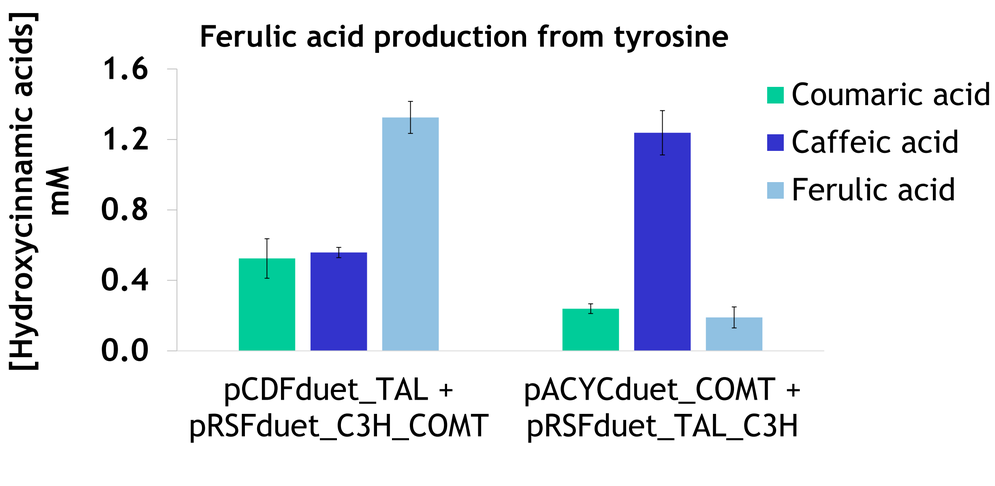
SOLUTION: SYNTHETIC BIOLOGY

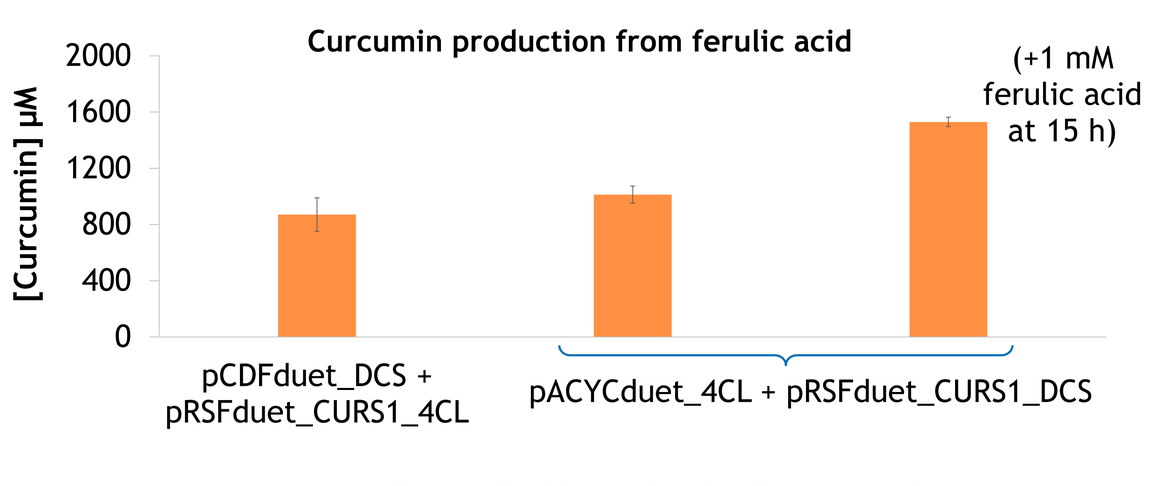
E. coli

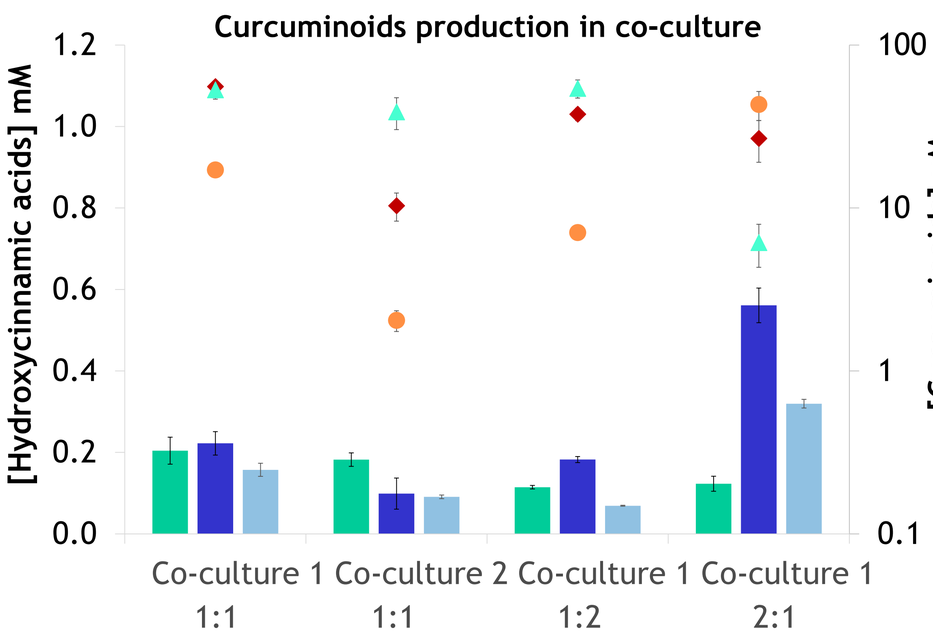
Polyphenols Market: $ 2.26 billion by 2027



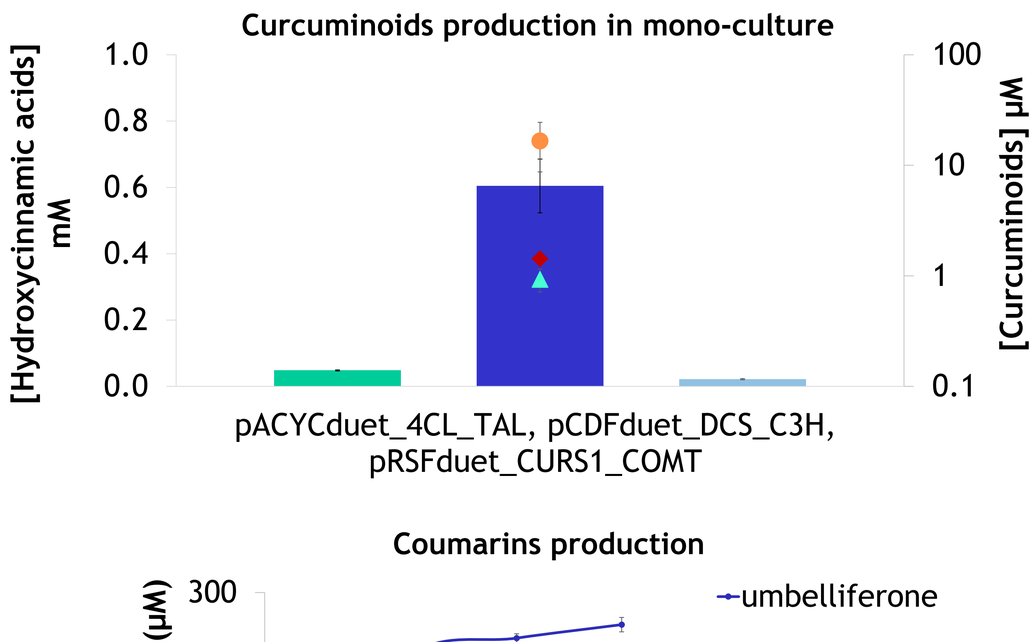
Results



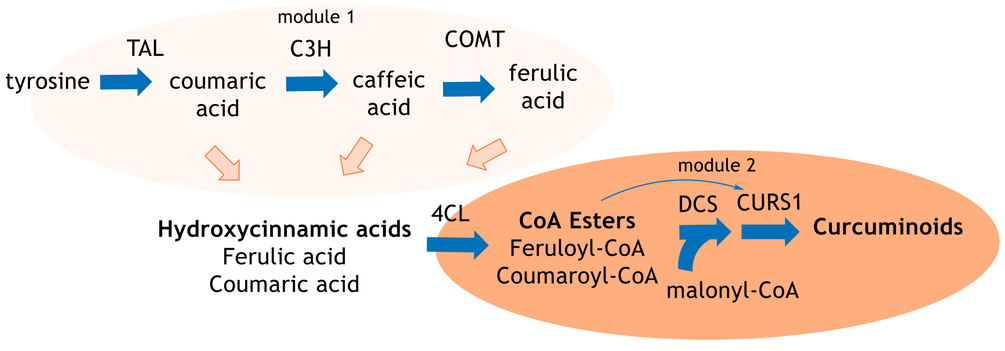


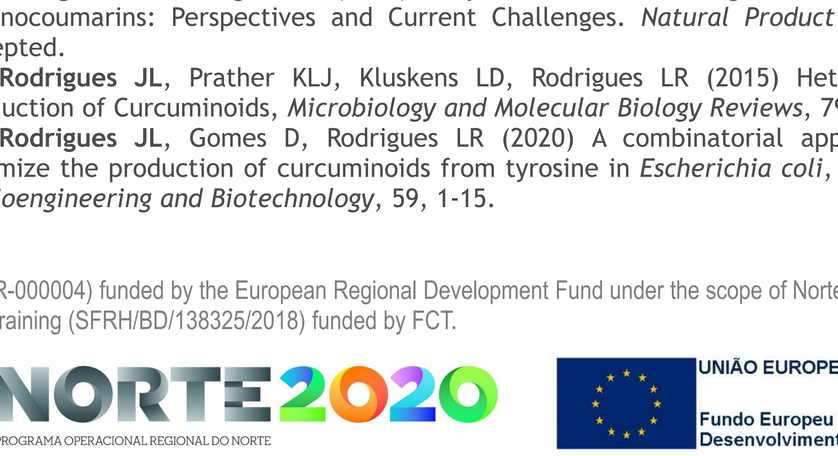


Module 1
Co-culture 1:
pCDFduet_TAL + pRSFduet_C3H_COMT
Co-culture 2:
pRSFduet_TAL_C3H + pACYCduet_COMT



Co-culture population was followed due to curcuminoids production and by blue-white screening due to *lacZ* disruption using **CRISPR-Cas9**





pAC-4CL + pET28-GST-C2'H (+ pCDFduet_TAL)

Conclusions

Module 1: [Ferulic acid] = 1325 µM
Module 2: [Curcumin] = 1530 µM
Mono-culture: [Curcuminoids] = 19 µM
Co-culture: [Curcuminoids] = 126 µM

Highest productions reported so far

[Umbelliferone] = 263 µM

Acronyms

TAL: tyrosine ammonia lyase from *Rhodotorula glutinis*
C3H: 4-coumarate 3-hydroxylase from *Saccharothrix espanaensis*
COMT: caffeic acid O-methyltransferase from *Arabidopsis thaliana*
4CL: 4-coumarate-CoA ligase from *A. thaliana*
DCS: diketide-CoA synthase from *Curcuma longa*
CURS 1: curcumin synthase 1 from *C. longa*
C2'H: coumaroyl-CoA 2'-hydroxylase from *Ipomoea batatas*
GST: glutathione-S-transferase

References

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